

CASSINI'S ULTRAVIOLET SPECTROMETER VIEWS JUPITER'S IO TORUS

LARRY W. ESPOSITO
UNIVERSITY OF
COLORADO

UVIS

- UVIS STANDS FOR 'ULTRA-VIOLET IMAGING SPECTROMETER'
- ULTRA-VIOLET IS INVISIBLE LIGHT BEYOND THE BLUEST COLOR THE HUMAN EYE CAN SEE
- UVIS OBSERVES THE PLANETS IN THESE INVISIBLE COLORS, BOTH 'FAR' AND 'EXTREME' ULTRA-VIOLET!
- MANY ELEMENTS HAVE CHARACTERISTIC COLORS VISIBLE ONLY IN THE ULTRA-VIOLET

MORE ABOUT UVIS

- UVIS HAS FOUR TELESCOPES TO VIEW PLANETS, MOONS, RINGS AND STARS
- UVIS HAS SPECIAL SOLID-STATE DETECTORS THAT CAN SEE THE ULTRA-VIOLET LIGHT
- UVIS SEPARATES THE LIGHT INTO 2048 DIFFERENT COLORS, LIKE A PRISM MAKES A RAINBOW
- UVIS ALSO MAKES PICTURES LIKE A VIDEO CAMERA (THAT'S WHY IT'S AN 'IMAGING' SPECTROMETER)

CASSINI

- CASSINI IS THE US-EUROPEAN SPACE MISSION TO ORBIT SATURN, WITH UVIS ON BOARD
- ON 30 DECEMBER 2000, CASSINI FLEW BY JUPITER, GETTING A GRAVITATIONAL PUSH TOWARD SATURN
- UVIS AND THE OTHER CASSINI EXPERIMENTS TOOK A CLOSE LOOK AT JUPITER AS WE FLEW BY
- UVIS OBSERVES JUPITER FROM 1 OCTOBER 2000 UNTIL 22 MARCH 2001

HOW UVIS WORKS

- CASSINI POINTS TOWARD JUPITER
- THE CASSINI SPACECRAFT GIVES IT THE TRIGGER COMMAND TO 'GO'
- UVIS OPERATES BY COMPUTER COMMANDS FROM ITS OWN MINI-COMPUTER'S MEMORY
- IT EXECUTES ONE COMMAND AFTER ANOTHER IN SEQUENCE
- CASSINI SENDS THE INFORMATION BY RADIO
- ON EARTH, WE CONVERT THE RADIO TO PICTURES AND MOVIES

UVIS SCIENCE GOALS

- UVIS IDENTIFIES ELEMENTS BY THEIR PARTICULAR ULTRAVIOLET LIGHT THEY GIVE OFF
- EACH COLOR IS LIKE A FINGERPRINT
- OUR GOAL IS TO FIND ATOMS IN SPACE, ATMOSPHERES AND ON MOONS
- WE WATCH THEM MOVE, DISCOVER WHERE THEY COME FROM AND WHERE THEY GO
- WE STUDY CLOUDS, GASES, MOONS & RINGS

HOW BIG IS UVIS

- IT'S THE SIZE OF A SMALL CARRY-ON BAG
- IT MEETS FAA REGULATIONS FOR UNDERSEAT LUGGAGE
- IT IS MOSTLY MADE OF ALUMINUM
- IT WEIGHS 31 POUNDS

NEXT:

**A MOVIE WE MADE FROM OUR PICTURES
OF JUPITER
IN ULTRAVIOLET LIGHT**

CASSINI UVIS IO TORUS MOVIE

LARRY ESPOSITO
AND
THE UVIS TEAM

JUPITER'S IO TORUS

- A DONUT OF GLOWING GAS ORBITING JUPITER
- MOSTLY SULFUR AND OXYGEN GASES FROM IO'S VOLCANIC ERUPTIONS
- THE LIGHT FROM THE GASES IS MOSTLY INVISIBLE TO THE HUMAN EYE, BUT CAN BE SEEN BY CASSINI'S UVIS IN THE EXTREME ULTRAVIOLET
- THESE GASES HAVE LOST ELECTRONS AND ARE HELD IN PLACE BY JUPITER'S MAGNETIC FIELD, WHICH SPINS ONCE EACH JUPITER DAY

COMPUTER ANIMATION OF IO TORUS

- PRODUCED FROM THEORETICAL MODELS
- JUPITER IN CENTER, ARROWS SHOW GEOGRAPHIC AND MAGNETIC POLE
- OFFSET OF MAGNETIC POLE CAUSES THE IO TORUS TO WOBBLE AS JUPITER ROTATES

QuickTime™ and a
Video decompressor
are needed to see this picture.

To view this animation download file name “jupbrot.mov”
Located at
http://www.jpl.nasa.gov/jupiterflyby/events/events_index.html

CASSINI UVIS TORUS MOVIE

- OBSERVATIONS FROM 11 NOVEMBER 2000
- CONTINUOUS 27 HOUR COVERAGE (ABOUT THREE JUPITER DAYS)
- JUPITER ITSELF WAS EDITED OUT
- MOVIE IS THE SUM OF THE LIGHT FROM THE FOUR BRIGHTEST EMISSION LINES
- THE BRIGHTEST PARTS ARE OVER-EXPOSED TO BRING OUT THE DETAILS
- NOTE THAT THE REAL TORUS IS MUCH MORE PATCHY THAN THE THEORETICAL MODEL

WHAT TO WATCH FOR

- TORUS WOBBLES AND ROTATES
- DUSK (RIGHT SIDE) IS BRIGHTER THAN DAWN (LEFT) SIDE
- TORUS BRIGHTENS NEAR LONGITUDE 210° (WATCH AS THE MOVING DOT REACHES LEFT EDGE). THE DOT ROTATES WITH JUPITER

UVIS TORUS MOVIE

QuickTime™ and a
GIF decompressor
are needed to see this picture.

To view movie view download file name “316t2_movie2.mov”

Located at

http://www.jpl.nasa.gov/jupiterflyby/events/events_index.html

SUM OF FIVE JUPITER DAYS

- OBSERVATIONS FROM 5 DAYS SORTED BY JUPITER LONGITUDE
- ADDED TOGETHER TO MAKE BRIGHTER MOVIE
- MOVING DOT ROTATES IN ONE JUPITER DAY (ABOUT 10 HOURS)

FIVE DAY SUM

QuickTime™ and a
Video decompressor
are needed to see this picture.

To view movie view download file name “315-319movie2.mov”

Located at

http://www.jpl.nasa.gov/jupiterflyby/events/events_index.html

WHAT DOES IT MEAN?

- WE CAN WATCH THE DYNAMICS OF THE IO TORUS, AS IT RESPONDS TO VOLCANIC ERUPTIONS ON IO, AND TO CHANGES IN JUPITER'S MAGNETIC FIELD
- IO'S TORUS IS MORE VARIABLE THAN WE HAD THOUGHT
- WE CAN DISCOVER THE PHYSICS OF THESE GLOWING ATOMS

PRODUCED BY:

- IAN STEWART (IDL)
- IONE CALEY (QUICKTIME)
- LARRY ESPOSITO (POWERPOINT)

- 23 DECEMBER 2000

WHAT'S NEXT?

- IN THE NEXT FEW MONTHS, UVIS WILL CONTINUE TO OBSERVE JUPITER, THE IO TORUS, AND JUPITER'S MOONS AND AURORA
- AFTER JUPITER, WE CRUISE OUT TO SATURN
- AT SATURN, WE GO INTO ORBIT ON 1 JULY 2004
- AND OBSERVE SATURN, ITS RINGS AND MOONS FOR FOUR YEARS

**THANKS FOR YOUR
ATTENTION**

THE END